RELEVANCE OF LEARNED-CENTERED EDUCATION TO THE EDUCATIONAL DEVELOPMENT OF SECONDARY SCHOOL STUDENTS IN ENUGU STATE

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Abstract
The study investigated the relevance of learned-centered education to the educational development of Enugu State. The study used mean and standard deviation to answer two research questions. Two hypotheses were tested using t-test statistics at the 0.05 level of significance. The design of the study is descriptive. With a population of 665 students, it consists of 250 respondents: one hundred fifteen males and one hundred and thirty-five females. The instrument for data collection structured by the researchers is known as the learner-centered education development (LCED). Cronbach's alpha formula was used to determine the reliability of the instrument, which has an index of 0.95 for LCED. The results showed that there was no significant difference in the mean score of male and female students on learner-centered education that contributes to the development of Enugu State. There is no significant difference in the mean score of urban and rural students on learner-centered education that empowers learners to take ownership of what they have learned. In accordance with the findings of the study, school administrators should support learner-centered management and endeavour to provide training and skills to teachers to enable the students and teachers to have higher outcomes and success.

Keywords: Relevance, Learned-Centered Education, Education and Development

Introduction
Education equips students in advance for the challenges of life. Education preserves and refines collective value anchored in the culture of society. (Bolariwa, 2014) Education provides skills, knowledge, and habits that are passed on from generation to generation, thereby becoming a collective benefit of society and effective citizenship. Education empowers students, society, and individuals to become all-round thinkers by giving them ability, attitudes, and skills; by that means, strengthening their problem-solving capability. For a learner to achieve this, they should be taught in a manner that enables them to engage in the process. Mba (2014) states that for meaningful development of any country, education is the bedrock. The role of education is important in the development of the human resources of a country. No country can develop beyond its citizenry level of education who form the country's human. The Nigerian government started educational programs so as to eradicate illiteracy, which impedes sustainable development. Education promotes development such as political, economic, cultural, and social emancipation of a

nation. Education has three stages: primary, secondary, and tertiary. Tertiary education is important as it accelerates social change, economic sustainability, and human development. In Nigeria, tertiary education provides manpower for all human needs (Ekundayo & Ajayi (2009).

The process of teaching and learning is a vital activity for teachers and students in the school. It enables learners to undergo behavioral changes and mental development. Teaching and learning activities are conveyed by teachers and students; here, teachers display a vital role in carrying out the process, thereby making the students active learners (Ronald & David, 2001). There are two broad ways of teaching at various educational levels: the student-centered and teacher-centered method. To participate in learning, learners should be given a chance to participate actively in the learning by offering them avenues to become active learners, equipped for their future careers, college work, and undertakings in life. The classroom serves as a place for the academic growth of students. As a result, teachers perform an important role in the teaching and learning of students. They are facilitators in the delivery of curriculum, the process, and instructions. They equip, guide, and prepare the students with skills and knowledge to face the challenges and realities of the world. The departmental program in faculty should integrate and sustain learner-centered teaching for teachers to be updated on current techniques and strategies of learner-centered teaching. This will enable students to be engaged in meaningful activities through which they form attitudes, skills, and. knowledge.

According to Otukil-Mongwaketse (2018), when education is teacher-centered, the teacher controls the classroom and activities, which enables students to ask questions, express themselves, and direct their own learning. When teachers dominate the teaching and learning process, the students lose the opportunity to become more advanced as compared to when they are constructing their own skills and knowledge. Learning-centered education, noted as student-centered learning, comprises teaching methods that change from teacher instruction to students constructing their own skills and knowledge (Jones, 2007).

In the words of Hannafin (2010), the objective of learning-centered education is to change learner's autonomy and independence by handing over the obligation of learning to students by imparting knowledge and skills required to measure up performance. Learning-centered education places student's interests first and recognizes them as central to the learning experience. In learner-centered learning, students decide on what to learn, how to learn, and the assessment. Learning-centered education provides a chance for students to collaborate with one another, answer their peers's questions, and show the results of their work. Hannafin (2010) states that learning-centered education differs from traditional education; here teachers participate actively in their roles while students part-take passively in the class. In teacher-centered learning, teachers decide what the students will learn, how the students will learn, and the mode of assessment. According to Johnson (2013), student-centered learning may be referred to as an education mindset of method of instruction that takes cognizance of individual differences in learners.

Student-centered learning stresses each student's ability, learning style, and interest, having the teacher as a facilitator of learning for every student instead of the class as a whole. Karamustafaoglu (2009) emphasizes learner-centered strategies of teaching whereby students become active participants in the learning process and engage in activities like discussion, writing, problem solving, and reading that promote synthesis, analysis, and evaluation of class content. Simulation, problem-based learning, cooperative learning, and the use of case methods are some of the strategies that promote learning. When the students are actively engaged, it brings additional energy to a classroom, motivates deeper thinking of the course content, and helps the instructor pin point the problem area. Student-centered methods enable the students to develop thinking skills, such as evaluation, and give the teacher feedback to identify which learners understand and who needs help.

Statement of the Problem

Learner-centered education enables the learners (students) to take charge of what they learn by focusing on how the new knowledge adds value and solves problems. Instead of imbibing information into the child's mind, the facilitator presents an issue and guides the students in the class as they discover solutions to the problem instead of waiting for the teacher's answer. Currently, class work needs collaborators willing to tackle and solve the problem, thus developing skills of exploring problem and taking decisions to trash the problem. Learner-centered education is an improvement over the teacher-centered educational system; it is a self-directed, project-based learning approach.

The researcher identified challenges in teachers-centered among other things were lack of confidence and interest, class size, lack of teachers and students interest, and students lack the skill of expressing their ideas. It is as a result of these problems identified in the study that researchers seek to examine the relevance of learner-centered education.

Purpose of the Study:

The main purpose of the study is to investigate the relevance of learner-centered education in educational development. Specifically the study intends to:

(1) determine the contribution of learner-centered education to the development of Enugu.
(2) identify the extent of learner-centered education and empower learners to take ownership.

Research Questions

The following research questions guide the study:

(1) To what extent does learners centered education contribute to the development of Enugu state?
(2) To what extent does learner–centered education empower learners to take ownership of what they have learnt?

Hypotheses

The following two hypotheses guide the study at .05 level of significant

HO_1: There is no significant difference in mean rating male and female learners centered education contribute to the development of Enugu state.

HO_2: There is no significant difference in mean rating urban and rural learner –centered education empower learners to take ownership of what they have learnt

Method

Design: descriptive survey design; this design involves collecting data from a sample of the population through their response to a question (Ali, 2006). The design is appropriate because it identifies, determines, or describes situations or events as they are (Ali, 2006).The area of study is the Enugu State, precisely Enugu North educational zone The choice of area is based on the researcher's familiarity with the location, which will grant them the opportunity to supervise and monitor the whole area. The population of the study is six hundred and sixty-five (665) students of a public secondary school in Enugu North local government area. The reason for the population is to know the relevance of learner-centered education in the educational development of Enugu State. The sample size is two hundred and fifty students (250). The sample proportion of the population was calculated using Kumar's manual of sampling. The data collection was analyzed using the mean and standard deviation. The research used responses such as very large extent, Large extent Very small extent and. Small extent. Instruments were developed by the researcher from the data collected in this study. The instrument is learner-centered education development (LCED). The instrument was validated by three experts, one from measurement and evaluation and the others from science education, all from the University of Nigeria, Nsukka. Cronbach's alpha internal consistency method was used to determine the reliability of the instrument. An internal consistency reliability of 0.95 was established for the instrument. Research questions were answered using the mean and standard deviation, with a mean of 2.50 as the benchmark for the decision rule. Any item with a mean score equal to or above the criterion mean of 2.50 is considered to be accepted. Any item that scores below this criterion is not accepted. Hypotheses were tested using the t-test at .05 level of significance.

Results

Research Question 1: To what extent does learners centered education contribute to the development of Enugu state?

Table 1: Learners centered education contribute to the development of Enugu state

S/N	Contribution Of Learner Centered Education To The Development Of Enugu		SD	REM
1	Develop learner's ability obtain information through research	3.12	1.14	LE
2	Enable students to gain higher level of thinking skill	3.19	0.90	LE
3	Help learner to be productive	3.32	0.85	LE
4	Help to build learner's character	3.21	0.97	LE
5	Develop learner's confidence	3.24	0.85	LE
6	Build learner's habit with regard of time management	3.33	0.86	LE
	Grand Mean	3.24		

Table 1 above represents the contribution of learner-centered education to the development of Enugu. The table discloses that mean scores range from 3.12 to 3.33. Build learner's habits with regard to time management ranked highest with a mean of 3.33 and a standard deviation of 0.86. Evidence on the table above shows that all the responses ranked positive since they fall above the minimum level of 2.50 and the overall mean score is 3.24. This indicates that learner-centered education contributes to the development of Enugu State.

HO1: There is no significant difference in mean rating between male and female learners. Learner-centered education contributes to the development of Enugu State.

Table 2 t-test analysis of there is no significant difference in mean rating male and female learners centered education contribute to the development of Enugu state

Table 2: Summary of t-test analysis on the mean rating scores of male and female students on: learner-centered education contributes to the development of Enugu state

Variables	**N**		**SD**	**Df**	**tcal**	**Sig.**	**Dec**
Male	1 15	3.24	.894	248	.348	.287	NS
Female	135	3.20	.844				

Key: N = sample size, mean, S = Standard Deviation, df = Degree of Freedom, Dec = Decision, NS = Not Significant

Data in table 2 showed that an independent-sample t-test was conducted to test the mean rating of male and female students on learner-centered education contribute to the development of Enugu state. The mean and standard deviation as shown in the table are male (=3.24, SD =.894) and female (=3.20, SD =.844). From the result of the t-test, it was found that the calculated value (0.348) is less than the tabulated value (1.660). Therefore, we fail to reject the null hypothesis that there is no significant difference in the mean score of male and female students on learner-centered education that contributes to the development of Enugu State.

Research Question 2: To what extent does learner-centered education empower learners (students) to take ownership of what they have learned?

Table 3: Learner-centered education empowers learners to take ownership of what they have learned

S/N	learner –centered education empower learners to take ownership of what they have learnt		SD	REM
1	Learners are engaged actively	3.12	I.i4	L E
2	Learners bear responsible for their own learning	3.21	0.97	L E
3	Learners study how to learn	3.32	0.85	L E
4	Learners form habits for life long learning	3.33	0.86	LE
5	Student retain understanding and knowledge.	3.32	0.85	L E
6	Learner acquire social skills by working with others.	3.16	0.92	L E
	Grand Mean	3.24		

The Table above represents learner-centered education that empowers learners (students) to take ownership of what they have learned. The Table discloses that the mean score ranges from 3.12 to 3.33. Learners form habits for lifelong learning ranked highest with a mean score of 3.33 with a standard deviation of 0.86. Evidence on the table above shows that all the responses ranked positive since they fall above the minimum level of 2.50 and the overall mean score is 3.24. This indicates that learner-centered education empowers learners (students) to take ownership of what they have learned.

HO_2 There is no significant difference in the mean rating between urban and rural learner-centered education. Learners-centered education empowers learners to take ownership of what they have learned.

Table 4: Summary of t-test analysis on the mean rating scores of urban and rural students on learner-centered education empowers learners to take ownership of what they have learned.

Variables	N		SD	Df	tcal	Sig.	Dec
Urban	150	3.21	.887				
				245	-1.257	.155	NS
Rural	100	3.35	.754				

Key: N = sample size , = mean, S = Standard Deviation, df = Degree of Freedom, Dec = Decision, NS = Not Significant

Data in table 4 showed that an independent-sample t-test was conducted to test the mean rating of male and female students on learner-centered education that empowers learners to take ownership of what they have learned. The mean and standard deviation as shown in the table are male (=3.21, SD =.887) and female (=3.35, SD =.754). From the result of the t-test, it was found that the calculated value (-1.257) is less than the tabulated value (1.660). Therefore, we fail to reject the null hypothesis that there is no significant difference in the mean score of urban and rural students on learner-centered education that empowers learners to take ownership of what they have learned.

Discussion of the Findings

Education is important in the development of any country. Teaching and learning empower the learner to comprehend the world he lives in and be curious about it. It is necessary to lay emphasis on different teaching methods that enable the learners to improve on academics as well as solve their problems. Learner-centered education, to a large extent, has made a contribution to the development of education in Enugu State. There is no significant difference in the mean score of male and female students on learner-centered education contributing to the development of Enugu State; this indicated that learner-centered education builds up desire for learner's lifelong learning, retains, maintains knowledge, and acquires actively social skills while working with other people. Learning-centered education enables the learner to be independent and autonomous in handling his responsibility in learning. This is in accordance with Hannafin (2010), who said that learning-centered education develops learner's independence and autonomy by handing over responsibility for learning to students by imparting knowledge and skills required to measure up performance**.** There is no significant difference in the mean score of urban and rural students on learner –centered education empower learners to take ownership of what they have learnt. Learner centered education empower (students) to take ownership of what they have leant this indicate, students construct meaningfully their own skills and knowledge. This enables students to be engaged in meaningful activities through which they develop their attitudes, knowledge and skill. This is aligned with

Jones's (2007) state that student-centered learning includes teaching methods that shift from teacher instruction to students constructing their own skills and knowledge. This is aligned with Jones's (2007) state that student-centered learning includes teaching methods that shift from teacher instruction to students constructing their own skills and knowledge. In learner-centered learning, students are motivated and encouraged to reflect on learning materials and partake in collaboration at the appropriate time. Learners are instructed individually. Moreover, while working with others, they gain skill, form a desire for a long life, and the learner takes charge of their own understanding.

Conclusion:

The way teachers handle students creates imparts on students to support the learning process. Teachers' strategies and approaches influence the students' learning strategies and skills; hence, teachers are encouraged to be more learner-centered in their teaching. When teachers teaching methods are more learner-centered in the class, the learning strategies and skills increase greatly because teachers provide more methods to enhance the learning strategies and skills of the students. Learner-centered Is an approach for students to develop their learning by doing? It is essential that learners are involved and engaged in their learning process; this will enable them to adapt learning strategies and skills and become responsible learners.

Recommendations:

The following recommendations were made based on the findings.

There is a need for school administrators to support learner-centered management and endeavor to provide training and skills to teachers; this enables the students and teachers to have higher outcomes and success. Further, classrooms have students of different learning styles and needs; hence, teachers should use individualized student-centered classroom management techniques to ensure all students are successful.

In the implementation of learning-centered education, there is a need to address the issue of dilemmas; these include class size, curriculum design, shortage of teachers, and shortage of instructional resources and facilities.

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AWARENESS AND UTILIZATION OF IMPROVISATION STRATEGY IN THE TEACHING AND LEARNING OF CHEMISTRY IN ENUGU EDUCATION ZONE OF ENUGU STATE

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Abstract
This study investigated the awareness and utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone of Enugu State. Two research questions and four null hypotheses guided the study. The researcher adopted census survey research design for the study. The total population of 114 chemistry teachers in Enugu Education Zone participated in the study. The researcher developed a self-structured instrument called "Awareness and Utilization of Improvisation Strategy Scale (AUISS). The instrument has two sections, A and B. Section A is on the respondents bio-data while section B has 2 parts with 30 items. The instrument was a 4 point scale of very great extent, great extent, little extent and very little extent. The instrument was validated by three research experts. The researcher used Cronbach Alpha reliability estimate to analyze the data collected and a coefficient of .68, and .75, were obtained for clusters 1and 2, respectively. The overall reliability index stood at .86. Mean and Standard Deviation were used to answer the research questions while t-test was used to test the four null hypotheses that guided the study at 0.5 level of significance. The result of this study indicated that chemistry teachers in Enugu Education Zone of Enugu State are to a great extent aware of improvisation strategy in teaching and learning of chemistry in Enugu Education Zone of Enugu State, however the result indicated that to a great extent chemistry teachers in Enugu Education Zone of Enugu State utilized improvisation strategy in teaching and learning of chemistry in Enugu Education Zone of Enugu State. Gender of the chemistry teachers' was not found to have affected the chemistry teachers' extent of awareness and utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone. Whereas, location of the chemistry teachers was found to have affected the chemistry teachers' extent of awareness of improvisation strategy. More so, location of the chemistry teachers was found to have not affected the chemistry teachers' extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone of Enugu State. The researcher recommended that deliberate efforts should be made at supervising the utilization of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone of Enugu State.

Keywords: *Awareness, Utilization, Improvisation Teaching, Learning, Chemistry*

Introduction

Education all over the world is regarded as an indispensable tool for enhancing economic growth and national development. It is seen as the cornerstone of development because it forms the basis of literacy, skill acquisition, technological advancement, knowledge acquisition and ability to harness the natural resources of the environment (Okoro, 2014). Antai and Anam (2019) asserted that education nurtures better citizens and helps to upgrade the general standard of living in a society. The education sector in any country is very important because education supplies the skilled manpower needed for the achievement of national economic goals and objectives. In the view of Adeogun (2010), education is a major instrument for tackling unemployment, poverty and ignorance. It is on this basis that the Federal Republic of Nigeria (FRN, 2013) outlined in her National Policy on Education, the cardinal aims of education which include among others;

> the development of the intellectual capacity of individuals to understand and appreciate their environment; and the acquisition of both physical and intellectual skills which will enable individuals develop into useful members of the community. These skills are acquired in formal education settings from primary, secondary and tertiary institutions such as universities, polytechnics and colleges of education. For the purpose of this study, the focus will be on secondary education.

The secondary education is one aspect of educational institutions in Nigeria that is designed specifically to train and prepare students for middle-level services in both manufacturing and service industries. One of the objectives of secondary education according to Atuyi (2019) is the acquisition of both physical and intellectual skills which will enable individuals to be self-reliant and useful members of the society. It must be emphasized that secondary education in Nigeria is for six years duration, junior secondary school (3 years) and senior secondary school (3 years). The two stages are both vocational and academic in nature. The broad goal of secondary education as stated in the National Policy on Education is to prepare the individual citizen for useful living within the society and preparation for higher education (FRN, 2013). Chemistry is one of the core science subjects taught in the senior secondary.

Chemistry has been defined as a science of nature that deals with the properties of non-living substances, whose properties ranges from the preparation and changes that they undergo when such substances are subjected to adverse conditions of high temperature, high pressure, extreme cold and abnormal contact (Iheanyi, 2015). It is concerned with the impartation of knowledge on properties, components, transformations and interactions of matter (Emendu, 2014). Chemistry Education is therefore the systematic process of acquiring the fundamental knowledge about the universe. The importance of chemistry education to national development can never be over-emphasized. The teaching of chemistry helps to imbibe scientific knowledge and

stimulate science-oriented attitude in learners. Undoubtedly, this attitude when directed to the world of work results in the development of the individual, the society and general standard of living of the citizenry. Therefore, the place of chemistry knowledge and skills in economic and industrial development in the Nigerian society cannot be underestimated.

Chemistry is seen as a difficult subject for many students containing many abstract concepts which are central to further learning in both chemistry and other science related discipline (Fatokun, Egwa & Uzoechi (2016). These abstract concepts are important because complex chemistry concept or theories cannot be easily understood if these underpinning concepts are not sufficiently grasped by students. Concepts such as dissolution, particulate nature of matter, periodicity, formulae and equations, chemical bonding are fundamental to learning chemistry. The root of many difficulties that students have in learning chemistry is traceable to inadequate understanding of these fundamental topics such as the periodicity (Olaniyan, 2018). Olaniyan further noted that most chemistry candidates for external examinations displayed inability to accurately write down chemical formula and balance simple equations. This is because students were not properly grounded in periodicity and balancing of equations. Weiss, Knowlton and Morrison (2017) also noted that many students have difficulties in recalling the position of elements in the periodic table and connecting the elements to their physical and chemical properties.

It must be emphasized that to ensure effective teaching and learning of Chemistry, lots of chemicals and equipment are required. It is on this basis that Ezeano (2012) opined that equipment can be used over and over again but the chemicals are expendables which are normally poured into sink after practical lessons. Sadly, most of the expendables are costly and always in short supply. Ezeano, further noted that the high cost and scarcity of chemicals do not permit effective teaching and learning of Chemistry and improved academic achievement. It is an obvious fact that chemicals or expendables are in short supply and practical lessons are being omitted as a result. Such being the case, there is need to seek for an alternative strategies of teaching Chemistry. Alternative teaching strategies that permit the use of locally available materials need to be sought to ensure that students are exposed to requisite chemistry experiences. Such alternative teaching strategies is referred to as cost reducing teaching strategies. Cost reducing strategies according to Ezeano (2012) include judicious use of expendables, small scale experiment, improvisation, among others, these strategies can be applied so that students will be effectively taught even during scarcity of teaching materials.

Improvisation is a method of cost reducing strategy in teaching and learning of chemistry. Improvisation as defined by Mogbo in Ezeano (2012) is the construction or creation of cheap and simple alternatives by the chemistry teachers in order to make the teaching and learning processes easier. Balogun (2015) defined improvisation as the act of using alternative materials and resources to facilitate instruction wherever there is lack or shortage of specific firsthand teaching aid. It is the use of products of look-alike object

to facilitate instruction. Adeniyi (2016) viewed improvisation as to adopt materials for use where normally other conventional items are employed. Nwaeze (2017) advocated two forms of improvisation, role substitute and role simulation. The role substitution form entails modification of the original materials in order to perform its function in an experimental setting. The role simulation form involves the actual construction of apparatus discarded materials or preparation of a new but a substitute material that can stand in place of the conventional one.

Improvisation involves the production of alternative materials to serve as a substitute in place of an existing but not available laboratory materials. Idris (2020) noted that materials for improvisation can be found in homes incinerators, market, school, welder's workshop and mechanic's workshop. Adeniyi (2016) stated that improvised materials which can be used in teaching practical chemistry among others include: malta bottles for reagents bottles, hibiscus flower pigment for indicator, methylated spirit lamp for bursen burner and other collection of chemical reagents from local resources. Idris (2020) suggested that plastic jerry can be used for stocking solution, transparent plastic cups for beakers and locally made Kepp's apparatus for standard Kipp's apparatus. Aronson (2013) asserted that broomsticks with plasticine rolled into ball can be used for molecule models and ear or eye-drops containers can serve as dropping pipette for indicators. Improvisation when applied helps to make available the needed materials for teaching and learning of chemistry in general and practical in particular (Ezeano, 2012). Improvised materials are cheaper than the conventional ones. It replaces the costly unavailable materials and helps in the achievement of learning objective. Idris (2020) noted that improvisation is more in use in the rural areas than the urban areas where conventional equipment are available in the various schools. Improvisation presents to the learners the properties as the real instructional materials in teaching learning process. Improvised materials according to Nwabunwanne (2011)

> Provide very rich visual experiences to all learners and afford them the opportunity of teaching and manipulating materials for direct concrete experiences.
> Promote quick understanding by arresting learners attention and give first-hand experience which are not easily forgotten to students, stimulate creative expressions in pupils and encourages active participation in the lesson.
> Afford the students the opportunity of individualized study and hence promote individualized instruction in chemistry teaching and learning.

Improvisation strategy may help to ameliorate the difficulties encountered by teachers during instructional delivery as noted by (Ibe, 2017). The question still remains whether the chemistry teachers are aware of improvisation strategy and the extent to which they utilize it in instructional delivery which would enhance teaching and learning

of chemistry concepts. The Chemistry teachers need to be aware of the existence of improvisation strategy so as to enable them fully utilize it in order to enhance effective teaching and learning in Chemistry. This is very important because, there is hardly any time the needed teaching materials are adequate in the secondary schools.

Awareness is defined as a human perception and cognitive reaction to a condition or event (Ezeano,2012) It is the knowledge or understanding of a particular subject or situation. Awareness in ordinary parlance means one having knowledge of the existence and usefulness of something. Reimer and Haines (2013) defined awareness as knowing who is around, what activities are going on and who is talking with whom. Apart from the chemistry teachers being aware of improvisation strategy there is the need for the utilization it. If the chemistry teachers are aware of improvisation strategy and fail to utilize them as a cost reducing strategy, it will do no good to teaching and learning. Improvisation strategy need to be effectively utilized by chemistry teachers so as to bridge the gap created by scarcity of teaching materials and enhance effective teaching and learning of Chemistry.

Utilization means the act or process of using a particular thing, idea or method for the actualization of a purpose (Hornby, 2010). Utilization of resources refers to the equitable use of resources accruable to an enterprise especially in the education industry for effective implementation of school curriculum (Nwabunwanne, 2012). Utilization of improvisation strategy in instructional delivery by Chemistry teachers requires teachers' knowledge of the various alternative instructional facilities, as well as an understanding of how students learn using varied improvisation strategy in teaching and learning (Petterson, 2011).Consequently, Ogbuegbuna-Okwenu (2014),opined that the non-use or underutilization of instructional facilities in schools is attributable to the teacher, explaining that facilities in education do not on their own achieve any meaningful values without being effectively utilized. The same could also be applicable to the utilization of various improvisation strategies. Thus, improvisation strategy will not on its own achieve any meaningful goal without being put into effective use by Chemistry teachers.

One influencing factor in the context of awareness and utilization, of any resources, in teaching and learning including improvisation strategy in instructional delivery is gender. Gender is the range of characteristics pertaining to and differentiating between masculinity and femininity (Ibe, 2018). Research has shown that gender issues affect all aspects of the society as regarding their profession, competencies in higher institution and so on, which actually reflects biasness in their performance level (Onuzulike, 2011). Although independent researches like Ibe (2018) and Onuzulike (2011) have found male performing better than female in the use of improvisation, a few others like Loyd and Gressand (2020) discovered that female out-performed the male, while some others established no significant difference use of improvisation, particularly in teaching and learning (Adeleke, 2016). Onuzulike (2011) stated that, gender has been identified as a critical factor that affects teachers' attitudes towards the use of improvisation in teaching of chemistry. Therefore, considering gender in this study could yield useful practical

information based on the controversy on issue of gender. There could be a significant difference in the level of awareness and utilization of improvisation strategy between male and female Chemistry teachers.

Another factor that may influence the awareness and level of utilization of improvisation strategy in instructional delivery in secondary schools is location. This has to do with the area or place the school is located. The school location also refers to whether the school is in Urban or in the Rural areas. Location may be defined as a place of settlement, activity or residence. Ibe (2018) noted that schools located at the urban areas are better financed and funded than those in the rural areas. Wagner, Hassanein and Head (2014) pointed out that the utilization of instructional resources, improvisation strategy inclusive in institutions is influenced by schools location which could make the procurement of instructional resources by these institutions difficult or easy, as the case may be. Also, noteworthy is the fact that the availability would also go a long way in determining the extent of awareness of the existence of the improvisation strategy. Thus, the awareness and utilization of improvisation strategy in secondary schools might differ. The rural and urban schools may differ in the quality of cost reducing strategies applied in the teaching and learning of Chemistry (Leem & Lim, 2017).

Considering the fact that the use of improvisation strategy in teaching and learning of chemistry may go a long way to improve teaching and learning of chemistry as well as practical teaching of chemistry, therefore it is essential to determine the extent to which chemistry teachers are aware of and the extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone of Enugu State.

Statement of the Problem

The nature of Chemistry demands that it should be taught practically, but the practical Chemistry lessons are rarely done effectively in most schools due to insufficiency of laboratory materials. Since the instructional materials for teaching and learning of Chemistry are in short supply it may lead to poor achievement in both internal and external examinations.

There is need for alternative teaching strategy which can allow effective teaching of Chemistry even when the conventional teaching materials are not adequately provided. Alternative teaching strategy such as improvisation can be useful.

More so, Chemistry could be taught even during the period of scarcity of conventional instructional materials and can help to remove the lapses that have led to poor exposure of students to practical experiences. Hence this study focuses on improvisation strategy to ensure that practical chemistry expendables are available. The issue still remains whether the chemistry teachers are aware and will be able to utilize the improvisation strategy, consequent upon these, the problem of this study put in question form is; To what extent are Chemistry teachers aware of and can utilize improvisation strategy in the teaching and learning of chemistry in Enugu Education Zone?

Purpose of the Study

The purpose of the study is to determine Chemistry teachers' awareness and utilization of improvisation strategy in teaching and learning of Chemistry in secondary schools in Enugu Educational Zone of Enugu State. Specifically, the study sought to determine the;

1. extent of chemistry teachers' awareness of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.
2. extent of chemistry teachers' utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Research Questions

The following research questions guided the study;

1. To what extent are chemistry teachers' aware of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone?
2. To what extent do chemistry teachers' utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone?

Hypotheses

The following null hypotheses were formulated and tested at .05 level of significance.

Ho_1: There is no significant difference in the mean response scores of male and female chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Ho_2: There is no significant difference in the mean response scores of male and female chemistry teachers on their extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Ho_3: There is no significant difference in the mean response scores of urban and rural chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Ho_4: There is no significant difference in the mean response scores of urban and rural chemistry teachers on the extent they utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Method

The researcher adopted census survey research design for this study. According to Idoko (2011) census survey research design is one which data is collected from every member of the target population. It is a design of statistical enumeration where all member of the population are studied. The census survey research design is therefore

considered most appropriate for this study because it allows the researchers to collect the original data and describe their condition as they exist in their natural setting. The population for the study is made up of 114 chemistry teachers currently serving in the 31 Government owned secondary schools in Enugu Education Zone. Among them are 38 male and 76 female teachers. This is based on the data obtained from the Post Primary School Management Board Enugu *(PPSMB, 2021/2022).* The total population of 114 was used for the study. No sampling was done. The researcher developed a self-structured instrument with the title "Awareness and Utilization of Improvisation Strategy Scale", (AUISS). The instrument has two sections; A and B. Section A contains the respondents' personal information while section B is divided into two clusters with 30 items structured to assist the researcher in providing clues to the research questions that guided the study. Cluster 1 is on extent of chemistry teachers' awareness of improvisation strategy with 15 items. Cluster 2 is on extent of chemistry teachers' utilization of improvisation strategies with 15 items. The response format for the instrument is a 4 point scale of Very Great Extent (VGE)=4 points: Great Extent(G E) =3 points: Little Extent (LE)=2points.VeryLittle Extent(VLE)=I point.

The instrument was validated by three experts, two from Department of Science Education, and one from the Measurement and Evaluation unit, Mathematics and Computer Department, all from the Faculty of Education in Enugu State University of Science and Technology. The researcher conducted a trial test using 20 respondents from Secondary schools in Agbani Education Zone. The respondents were assured of complete confidentiality of all information they supplied they were allowed to complete the instrument at their own convenience. The responses to the various items of the questionnaire were used in computing its reliability using Cronbach's alpha reliability estimate. The overall reliability index stood at .86 indicating that the instrument is highly reliable and suitable for the study. The researcher administered the instrument directly to the 114 respondents using two research assistants. The research assistants were briefed by the researchers on the conduct of the exercise, during which they were acquainted with the purpose of the study and how the questionnaire should be administered and collected. Appointments were booked with the respondents for collection at a later day for those who were not able to fill their own copies of the instrument because of the nature of their job. The researcher and the research assistants were able to retrieve all the 114 copies of the distributed questionnaire instrument, signifying 100% return rate. Data collected were analyzed using mean with standard deviation in order to answer the research questions. The null hypotheses were tested using t-test statistics at.05 level of significance. For the decision rule, all the items with mean score of 2.50 and above were accepted while those with mean score below 2. 50 were rejected. For the hypotheses, if the p-value at .05 level of significance is less than t-value or critical value of the t-test, the null hypothesis was not rejected, but if otherwise the null hypothesis was rejected.

Results

Research Question 1: To what extent are chemistry teachers aware of improvisation strategy in teaching and learning of chemistry in secondary school in Enugu Education Zone?

Table 1: Mean responses and standard deviation of the respondents on the extent of chemistry teachers' awareness of improvisation strategy in teaching and learning of chemistry in secondary school in Enugu Education Zone.

N=114

S/N	Extent of chemistry teachers awareness of improvisation strategy in teaching and learning of chemistry include being aware that;	VGE	GE	LE	VLE	$\bar{X}$	SD	DEC
1	malt bottles can replace reagent bottles	42	34	38	0	3.04	0.84	GE
2	Kerosene stove can stand for burner	41	32	39	2	2.98	0.88	GE
3	Plastic jars can stand for glassware	36	45	32	1	3.02	0.79	GE
4	Improvised pH paper to test the pH of acid-based solution	31	31	31	21	2.63	1.07	GE
5	Acid-base indicator can be gotten from red-cabbage juice	22	32	28	32	2.39	1.09	LE
6	flat pieces of metal can replace spatulas	42	42	25	5	3.06	0.88	GE
7	eye-drop containers can serve as dropping pipette for indicator	32	24	35	23	2.57	1.10	GE
8	teaspoon can stand in place of burette in titration experiment	19	35	25	35	2.33	1.08	LE
9	Graduated transparent plastic cups can be for beakers	34	44	36	0	2.98	0.79	GE
10	NaOH can be gotten from the ash of cassava peels	31	30	31	22	2.61	1.08	GE
11	KOH can be gotten from the ash of palm husks	24	34	27	29	2.46	1.09	LE
12	meter rule pivoted at the centre to show change in mass	43	41	30	0	3.11	0.79	GE
13	hibiscus flower pigment can be for indicator	47	34	33	0	3.12	0.83	GE
14	wooden spatula can stand in place of metal ones	43	42	24	5	3.08	0.87	GE
15	white sedimentary rock (nzu) for C_aCO_3	28	22	37	27	2.45	1.11	LE
	Grand Mean					**2.80**	**0.95**	

From Table 1 above, the results of data analysis for research question 1 indicated that items (1,2,3,4,6,7,9,10,12,13 and 14) had mean responses that were higher than the

cut-off point of 2.50.Only items (5,8,11,and15) had mean responses that were below the cut- off point of 2.05. The value of the grand mean was also high. This means that the respondents agreed that chemistry teachers appear to be aware of improvisation strategy to a great extent in teaching and learning of chemistry in secondary school in Enugu Education Zone.

Research Question 2

To what extent do chemistry teachers utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone?

Table 2: Mean responses and standard deviation of the respondents on the extent chemistry teachers utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

N = 114

S/N	Chemistry teachers utilization of improvisation strategy include: chemistry teachers utilize	VGE	GE	LE	VLE	$\bar{x}$	SD	DEC
16	malt bottles for reagent bottles	41	36	36	1	3.03	0.85	GE
17	Kerosene stove for burner	37	35	41	1	2.95	0.85	GE
18	Plastic jars for glassware	29	47	38	0	2.92	0.77	GE
19	Improvised PH paper to test the PH of acid-based solution	35	42	37	0	2.98	0.79	GE
20	Acid-base indicator from red-cabbage juice	35	42	37	0	2.98	0.79	GE
21	flat pieces of metal as spatulas	56	58	0	0	3.50	0.50	GE
22	eye-drop containers as dropping pipette for indicator	29	47	38	0	2.92	0.77	GE
23	teaspoon in place of burette in titration experiment	35	42	37	0	2.98	0.79	GE
24	Graduated transparent plastic cups for beakers	56	58	0	0	3.49	0.50	GE
25	NaOH from the ash of cassava peels	29	47	38	0	2.92	0.77	GE
26	KOH from the ash of palm husks	29	47	38	0	2.92	0.77	GE
27	meter rule pivoted at the centre to show change in mass	29	48	37	0	2.93	0.76	GE
28	hibiscus flower pigment for indicator	29	48	37	0	2.93	0.76	GE
29	wooden spatula in place of metal ones	27	37	24	26	2.57	1.08	GE
30	white sedimentary rock (nzu) for C_aCO_3	27	3	24	26	2.57	1.08	GE
	Grand Mean					**2.97**	**0.78**	

From Table 2 above, the mean responses to the items (16-30) were higher than the cut-off point of 2.50, mining that the respondents agreed that the chemistry teachers to a

great extent appear to utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Hypothesis 1: There is no significant difference in the mean response scores of male and female chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone.

Table 3: t-test on the mean ratings of male and female chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone.

Gender	N	Mean	Std. Deviation	t	df	Sig.	Dec.
Male	38	2.70	1.092	1.303	112	.193	NS
Female	76	2.57	1.093				

Table 3 shows that the t value for the difference in mean rating of male and female chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone is 1.303, significant at .193 level of significance, which is higher than 0.05 set for the study. The null hypothesis is therefore not rejected. This means that there is no significant difference in the mean ratings of male and female chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone, as perceived by the teachers.

Hypothesis 2: There is no significant difference in the mean response scores of male and female chemistry teachers' extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Table 4: t-test on the mean ratings of male and female chemistry teachers' extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Gender	N	Mean	Std. Deviation	T	df	Sig.	Dec.
Male	38	2.64	1.09	.676	112	.289	NS
Female	76	2.56	1.123				

Table 4 shows that the t value for the difference in mean rating of male and female chemistry teachers extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone is .676, significant at .289

level of significance, which is higher than 0.05 set for the study. The null hypothesis is therefore not rejected. This means that there is no significant difference in the mean ratings of male and female chemistry teachers extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone, as perceived by the teachers.

Hypothesis 3: There is no significant difference in the mean response scores of urban and rural chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone.

Table 5: t-test on the mean ratings of urban and rural chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone.

Location	N	Mean	Std. Deviation	t	Df	Sig.	Dec.
Urban	97	2.54	1.090	-4.573	112	.000	S
Rural	17	3.00	.803				

Table 5 shows that the t value for the difference in mean rating of urban and rural chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu Education Zone is -4.573, significant at .000 level of significance, which is higher than 0.05 set for the study. The null hypothesis is therefore rejected. This means that there is significant difference in the mean ratings of urban and rural chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning chemistry in secondary schools in Enugu education zone, as perceived by the teachers.

Hypothesis 4: There is no significant difference in the mean response scores of urban and rural chemistry teacher's extent of utilization improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Table 6: t-test on the mean ratings of urban and rural chemistry teacher's extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Location	N	Mean	Std. Deviation	T	Df	Sig.	Dec.
Urban	97	2.99	.845	.523	112	.596	NS
Rural	17	2.94	.814				

Table 6 shows that the t value for the difference in mean rating of urban and rural chemistry teachers extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone is .523, significant at .596 level of significance, which is higher than 0.05 set for the study. The null hypothesis is therefore not rejected. This means that there is no significant difference in the mean ratings of urban and rural chemistry teacher's extent of utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Discussion of the Findings

Research question one, attempted to elicit the perception of the respondents on the extent chemistry teachers are aware of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone. Out of fifteen items articulated to answer the research question posed only four items got a mean point that indicated little extent. This shows that chemistry teachers to a great extent are aware of improvisation strategy in teaching and learning of chemistry in Enugu Education Zone. This finding agrees with Iheanyi (2015) which stated that chemistry teachers are to a reasonable extent aware of the cost reducing strategies which includes improvisation but are hindered by both personal reasons and environmental constraints. Therefore, there is need for an increased emphasis on improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.

Comparison between the mean response scores of male and female chemistry teachers and their extent of awareness of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone showed that there is no significant difference in the mean rating of male and female chemistry teachers and their extent of awareness of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone. This finding is in line with Utibe-Abasi (2015) noted that problems faced by teachers in the awareness and utilization of improvisation were not gender sensitive.

Similarly, on the influence of location of schools, it was found in this study that there is significant difference in the mean rating of urban and rural chemistry teachers on their extent of awareness of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone. This finding is in line with Leem and Lim (2017) which stated that rural and urban schools may differ in the quality of awareness and utilization of cost reducing strategies applied in the teaching and learning of chemistry Adeniyi (2016) observed that urban based chemistry teacher are to a great extent aware and apply cost reducing strategies such improvisation then their rural counterparts.

Research Question two which investigated the extent of chemistry teachers' utilization of improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone showed that chemistry teachers to a great extent utilize

improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone of Enugu State. This finding agrees with Nweze (2017) who noted that chemistry teachings in Nigeria use substitutes when the conventional chemicals are not found. Ezeano (2012) opined that improvised materials are cheaper than the conventional ones. It replaces the costly unavailable materials and help in the achievement of learning objective.

Investigation for significant difference between the mean response scores of male and female chemistry teachers on the extent to which they utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone showed that there is no significant, difference in the mean rate of male and female chemistry teachers on the extent to which they utilize improvisation strategy in teaching and learning of chemistry in Enugu Education of Enugu State. This finding is in consonance with Utibe-Abasi (2015) who stated that problems faced by teachers in the awareness and utilization of improvisation were not gender and location sensitive. Utilization of improvisation as a cost reducing strategy in instructional delivery by both male and female chemistry teachers requires teacher's knowledge as well as understanding of how students learn using varied cost reducing strategy in teaching and learning.

Comparism between the mean rating of urban and rural chemistry teachers on the extent to which they utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone indicated that there is no significant difference in the mean rating of urban and rural chemistry teachers on the extent of utilization of improvisation strategy in teaching and learning of chemistry in Enugu Education Zone of Enugu State. This finding agrees with Utibe-Abasi (2015) who revealed that gender and location do not constitute constraints in the use of improvisation in teaching and learning. Utibe-Abasi further noted that problems faced by teachers are not gender and location sensitive.

Recommendations

Based on the findings and implication of the results, the following recommendation was made:

1. Improvisation strategy should be highly emphasized and encouraged by the stake holders in education for secondary schools in Enugu Education Zone
2. Deliberate efforts should be made by education supervisors in ensuring that the chemistry teachers utilize improvisation strategy in teaching and learning of chemistry in secondary schools in Enugu Education Zone.
3. The school authorities should, on a regular basis, organize seminars, workshop and enlightenment programmes on utilization of improvisation strategy in teaching and learning of chemistry in secondary schools Enugu Education Zone.
6. There should be an increased awareness of improvisation strategy by the ministry of education in secondary schools in Enugu Education Zone of Enugu State.

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